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#82-11

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

82 3688

FOREST PEST MANAGEMENT

STATE & PRIVATE FORESTRY

6610
Report No. 82-11
September 1982

INTERMOUNTAIN REGION

HAZARD: A COMPUTER PROGRAM TO RATE POTENTIAL FOR MOUNTAIN PINE BEETLE ACTIVITY IN LODGEPOLE AND PONDEROSA PINE STANDS IN THE INTERMOUNTAIN REGION

By
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ABSTRACT

A computer program, HAZARD, which utilizes TMIS data bases to rate susceptibility of lodgepole and ponderosa pine stands to mountain pine beetle attack is now available for use by forest managers. Use of the program is described herein.

INTRODUCTION

Recently, systems for rating susceptibility (hazard) of lodgepole (*Pinus contorta* var. *latifolia* Eng.) and ponderosa (*Pinus ponderosa* Laws.) pines to attack by mountain pine beetle (*Dendroctonus ponderosae* Hopkins) have been described (Amman et al. 1977; Sartwell and Stevens 1975; Stevens et al. 1980). The system for lodgepole pine is based on stand elevation, latitude, average host diameter, and average age. The system for ponderosa pine is based on average host diameter, average age, stand species composition, and stand density.

With the exception of latitude, the above data are available for many forests in the Intermountain Region through the Timber Management Information System (TMIS) maintained at the Fort Collins Computer Center (FCCC).

This report documents the incorporation of the two hazard rating systems into one interactive computer program, HAZARD, which accesses the TMIS data base and classifies stands containing lodgepole pine or ponderosa pine into one of five mountain pine beetle (MPB) susceptibility groups. Latitude is incorporated into a rating scheme for each Forest. The following discussion documents the program and describes how to use it.

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THE PROGRAM HAZARD

HAZARD is accessible by demand terminals and is designed to interact with the user to gather information needed in selecting stands to be rated for MPB susceptibility. Although the program is easy to operate and checks for errors, knowledge of demand computing techniques, SYSTEM 2000, and TMIS is desirable since problems may develop which require user interaction. A recent copy of the TMIS Users' Manual (USDA Forest Service 1981) is needed since execution of HAZARD is similar to execution of SYSTEM 2000.

In brief, stands are selected from TMIS for rating if they fall within operator selected areas (i.e., District or compartment) having lodgepole or ponderosa pine as the forest type. Specific data is extracted from the data base for all stands located, and hazard ratings are computed. Stand record key numbers, unique for each stand, are then listed in one of five categories described later. Stands with missing data will not be rated but are listed separately.

To illustrate use of the program, portions of a run are presented, and explanations made for each step.

The program is executed by first accessing FCCC and entering a run statement with normal parameters and a TMIS qualifier:

```
@RUN RUNID, ACCOUNT NUMBER, QUALIFIER
```

Hazard can then be executed with the following command:

```
@XQT R4-FPM*HAZARD.S2K
```

Following are questions asked at the start of the program.

```
 @RUN R04AAA.T104395301[redacted].TMSASH
DATE: 050582  TIME: 135751
>@XQT R4-FPM*HAZARD.S2K
 PRIOR TO RUNNING THIS PROGRAM THE CONTROL AND STAND DATA BASES FOR
 YOUR FOREST MUST BE ACTIVE.
 ARE BOTH DATA BASES ACTIVE? Y OR N
>Y
 ENTER MODE YOU WISH TO RUN PROGRAM IN.
 D=DEMAND
 B=BATCH
>D
 ENTER FOREST YOU ARE HAZARD RATING - FOREST QUALIFIER MUST BE IN RUNSTREAM
 THAT WAS ENTERED AT BEGINING OF THIS RUN
>ASHLEY
 ENTER DISTRICT NUMBER YOU WISH TO HAZARD RATE. 0=ALL
 N
>2
 ENTER COMPARTMENT NUMBER YOU WISH TO HAZARD RATE. 0=ALL
 NNN
>0

 ** BEGIN SEARCH **
```

The user is asked whether both stand and control data bases are active (active means the data bases are on mass storage). If not, the program will stop execution, and the user must bring them up as outlined in the TMIS manual. If active, execution will continue, and the user is given a choice of executing the program in demand or batch mode. Demand mode is designed to handle small numbers of stands (less than 50) within limited time periods, whereas batch mode handles large amounts of data requiring long periods of time.

Ratings will be conducted at the Forest, District, compartment, or stand level depending on user requirements. District number is designated with a single-digit, while three digits are used to identify compartment and stand. For example, District 2 would be identified as "2" while compartment or stand 20 must be entered as "020". Note that where all Districts, compartments, or stands are to be rated, a 0 is entered. If a stand number is entered, that stand alone will be rated.

In the example, since demand mode was chosen, the search for lodgepole or ponderosa pine stands begins. If 50 or fewer lodgepole or ponderosa pine stands are located, the run will continue, and stands will be rated. If more than 50 stands are located, the user will be given the following response:

```
TOO MANY STANDS HAVE BEEN LOCATED TO HAZARD RATE IN DEMAND TIME LIMITS.
YOU MUST SELECT MORE SPECIFIC CRITERIA OR RUN IN BATCH MODE.
ENTER LETTER OF DESIRED OPTION
    B=BATCH RUN
    R=RESELECT CRITERIA
    T=TERMINATE PROGRAM
>B
```

Three options are allowed. If 'T' is chosen, the program will end. If 'R' is selected, the program will again ask for District, compartment, and stand to limit the area searched and hopefully select fewer than 50 stands that can be rated in demand mode. In this example, 'B' (Batch) was selected and the following response was produced. The same response would have been given if batch mode instead of demand mode had been selected at the beginning of the program.

```
ENTER YOUR 12 DIGIT ACCOUNT NUMBER
NNNNNNNNNNNN
>110439530188
ENTER SITE ID TO SEND OUTPUT.
NNNNNN
>FCR476
ENTER DATA BASE QUALIFIER EX. TMSPAY
>TMSASH
ENTER SIX CHARACTER RUN ID  EX. RQ4AAA
>RQ4AAA
YOUR RUNSTREAM IS IN THE FILE TMSASH.HAZARD140016.
IS IT OK TO FREE THIS FILE  Y OR N
>Y
RUNSTREAM FREE - PROGRAM ENDED
READY
```

The runstream created by this routine will execute the program in a batch mode at a 'P' priority and send the output to the printer at the chosen site ID. File names are unique for each run and should be retained so that changes in the runstream can be made with the text editor if mistakes are noticed. If one chooses not to free the runstream, the program will end, and the runstream will not be executed.

Program output includes separate listings of ponderosa pine and/or lodgepole pine stands. Each listing is classified into one of five susceptibility categories or a missing data category. In the latter case, critical data with which to hazard rate the stand is missing. An example of an entire runstream follows:

```
@RUN R04AAA.1104395301BB,TMSASH
DATE: 050582  TIME: 135047
>@XQT R4-FPM*HAZARD.S2K
 PRIOR TO RUNNING THIS PROGRAM THE CONTROL AND STAND DATA BASES FOR
 YOUR FOREST MUST BE ACTIVE.
 ARE BOTH DATA BASES ACTIVE? Y OR N
>Y
 ENTER MODE YOU WISH TO RUN PROGRAM IN.
 D=DEMAND
 B=BATCH
>D
 ENTER FOREST YOU ARE HAZARD RATING - FOREST QUALIFIER MUST BE IN RUNSTREAM
 THAT WAS ENTERED AT BEGINING OF THIS RUN
>ASHLEY
 ENTER DISTRICT NUMBER YOU WISH TO HAZARD RATE. 0=ALL
 N
>1
 ENTER COMPARTMENT NUMBER YOU WISH TO HAZARD RATE. 0=ALL
 NNN
>020
 ENTER STAND NUMBER YOU WISH TO HAZARD RATE. 0=ALL
 NNN
>0

 ** BEGIN SEARCH **
 NO STANDS FOUND FOR PP DATA SEARCH.
```

HIGH HAZARD .....CONDITIONS PRESENTLY EXIST WHICH PREDISPOSE THE STAND TO PEST ATTACK. CHANCE OF AN OUTBREAK DEVELOPING IN THESE AREAS IS IMMINENT.

MODERATE HAZARD ..CONDITIONS HAVE NOT YET REACHED THE HIGH HAZARD CATEGORY. DEPENDING ON THE GROWTH RATE. HIGH RISK CONDITIONS ARE EXPECTED TO BE ATTAINED WITHIN 20 YEARS. ALTHOUGH A PEST OUTBREAK WOULD PROBABLY NOT DEVELOP IN THE MODERATE HAZARD AREA. THESE STANDS WOULD PROBABLY BECOME INFESTED IF AN OUTBREAK WERE TO DEVELOP IN ADJACENT STANDS.

LOW HAZARD .....PRESENTLY STAND CONDITIONS WILL NOT SUPPORT A PEST OUTBREAK AND PERHAPS 30 YEARS ARE NEEDED FOR HIGH HAZARD CONDITIONS TO DEVELOP IN THESE AREAS. IF AN OUTBREAK WERE TO DEVELOP IN ADJACENT STANDS, THOSE LOW HAZARD AREAS WOULD PROBABLY BE ONLY SLIGHTLY IMPACTED.

HAZARD RATINGS FOR THE ASHLEY N.F. DISTRICT=1 COMPARTMENT= 20

LODGEPOLE PINE STANDS RATED FOR MOUNTAIN PINE BEETLE HAZARD

STANDS WITH HIGH HAZARD - IMMEDIATE ACTION REQUIRED:
1020002 1020004 1020013

STANDS WITH MODERATE-HIGH HAZARD - ACTION REQUIRED WITHIN 10 YEARS:
1020001 1020005 1020007 1020008 1020009
1020014 1020015 1020017

STANDS WITH MODERATE HAZARD - ACTION REQUIRED WITHIN 20 YEARS:
1020003 1020006 1020012 1020016 1020018
1020021

STANDS WITH LOW-MODERATE HAZARD - ACTION REQUIRED WITHIN 30 YEARS:
1020011

STANDS WITH LOW HAZARD - NO ACTION REQUIRED WITHIN 30 YEARS:
1020010 1020020

STANDS NOT RATED DUE TO MISSING DATA:
*** NO STANDS SELECTED ***

PONDEROSA PINE STANDS RATED FOR MOUNTAIN PINE BEETLE HAZARD
*** NO STANDS SELECTED ***

DISCUSSION

A computer program such as HAZARD aids the land manager in grouping lodgepole and/or ponderosa pine stands for which stand data are available into MPB susceptibility classes. Stands in imminent danger of attack should be harvested in order to minimize population buildup and accompanying mortality. Less susceptible stands can be scheduled into short-range action plans or long-range management plans.

HAZARD uses stand examination or inventory data stored in TMIS. Therefore only those stands for which data are available will be rated for MPB susceptibility. To rate susceptibility of stands for which data are unavailable, either data must be collected, or existing data must be extrapolated to stands with similar characteristics.

Several modifications to the program are planned and will be made available once testing has been completed. These changes include the addition of routines to risk-rate stands for other insects and to summarize disease occurrence.

LITERATURE CITED

Amman, Gene D., Mark D. McGregor, Donn B. Cahill, and William H. Klein. 1977. Guidelines for reducing losses of lodgepole pine to the mountain pine beetle in unmanaged stands in the Rocky Mountains. USDA Forest Service General Technical Report INT-36, 19 p. Intermountain Forest and Range Experiment Station, Ogden, Utah.

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